Robert L. Bates

# Journal of Geological Education

Volume 6 - Number 1

Spring 1958

Published semiannually by

THE ASSOCIATION OF GEOLOGY TEACHERS

## CONTENTS


The Teaching of Geology in Hungary ..... *István Ferenczi* 1

Geology Teaching at the University Level ..... *C. G. Higgins* 5

Research in Geology ..... *Lloyd W. Staples* 7

Teaching and Research: Immiscible Components or Isomorphous Series? ..... *Ian Campbell* 11

Research and Effective Teaching in the Geological Sciences ..... *Byron N. Cooper* 15

Some Relationships of Teaching and Research Research in Geology ..... *Grover E. Murray* 19

Scholarship in Geology ..... *William R. Thurston* 22

Motion Pictures for Geologic Teaching ..... *Hall Taylor* 24

Book Reviews

Richard Foster Flint: Glacial and Pleistocene Geology ..... *Sidney E. White* 31

W. D. Keller: Chemistry in Introductory Geology ..... *C. T. Bressler* 32

Aurèle La Rocque: The Admirable Discourses of Bernard Palissy ..... *A. O. Woodford* 32

Reversable Barchans ..... *A. Scott Warthin, Jr.* 18

Transactions of the Association of Geology Teachers ..... 34



The JOURNAL OF GEOLOGICAL EDUCATION is published by the Association of Geology Teachers semiannually in the spring and fall, at the Heer Printing Company, Columbus, Ohio.
Single issues: $1.25 for Vol. 2, No. 2 and later issues; $1.00 for Vol. 1, Nos. 1-6 and Vol. 2, No. 1

Address all communications regarding subscriptions, orders for single issues and back issues, changes of address, etc. to the national treasurer of AGT:

James C. Brice, Department of Geology
Washington University, St. Louis, Missouri

Submit all manuscript to the editor:

Mildred F. Marple, Department of Geology
The Ohio State University, Columbus 10, Ohio

Journal of Geological Education

Volume 6 Spring 1958 Number 1

JOURNAL OF GEOLOGICAL EDUCATION
Vol. 6, No. 1, Spring 1958

# THE TEACHING OF GEOLOGY IN HUNGARY

ISTVÁN FERENCZI
*North Carolina State College*

ABSTRACT. The professional education of geologists has long been a function of the leading universities of Hungary, but the number of students in this field was not large because of the limited demand for geologists in industry and in the Geological Survey. The loss of territory at the end of the first World War, particularly the loss of the regions containing the chief mineral resources, further restricted the need for geologists. The Communist Regime has greatly expanded the facilities for the teaching of geology and geological engineering in Hungarian universities, and the graduates are largely employed in undeveloped countries of eastern Europe and Asia.

Geology was taught in two universities in Hungary before the World Wars; the university at Budapest and the university at Kolozsvár. At the former, in addition to professorships of Mineralogy-Petrology and Geology, there was for a time a professorship of Paleontology, while at the latter all of these branches were included in one professorship. The same situation obtained at the Technical University at Budapest, while at the Academy of Forestry, Mining and Metallurgy at Selmecbánya two professors lectured on these subjects. At the university at Zagreb, in Croatia—at that time a part of Hungary—one professor served the geological sciences, lecturing in the Croatian language. Up to the end of World War I the new university at Debrecen maintained one professorship for these studies; the new university at Pozsony, however, remained without any such professorship.

The loss of about two-thirds of Hungary's territory at the end of the first World War changed this situation only by changing the site of some universities. The university of Kolozsvár moved to Szeged, that of Pozsony moved to Pécs—though still without a professor of geology—and finally, the Academy of Forestry, Mining, and Metallurgy moved from Selmecbánya to Sopron.

Between the two World Wars the new Agricultural and Economic University was founded at Budapest, and geology was included in its curriculum. The Academy of Forestry, now located at Sopron, was promoted to the rank of a university by annexation to the Technical University at Budapest. The teaching of geology was further expanded between 1940 and 1944 by the return of the university at Szeged to its old site at Kolozsvár with three professorships in the geological sciences instead of one, while in the newly founded university at Szeged two professorships were established, one for Geology and a second for Mineralogy and Petrology.

All of these universities were, and are, state universities, under the direction of the Ministry for Religion and Education. Each professorship was usually

filled by a full professor (Ordinarius), who was at the same time the Director of his Mineralogical and Geological Institute, or of one of the separated institutes. Each professor was supported by a staff consisting sometimes of an Adjunct who usually was authorized to substitute for the professor, lecturing in his absence; one or more Assistants (not called professors), who were entrusted with the leading of laboratory hours; and finally some junior members were added for helping with manual work such as labeling collected specimens, etc. The number of the staff was always dependent on the ability of the professor, who had to fight to acquire more members for his institute through the budget of the university.

It is obvious that one professor assigned to geology and its closely related sciences was not able to give detailed lectures in all branches. Each professor, if he really took care of his institute and professorship, tried to establish more and more so-called Docents or Privatedocents. They were not employees of the university and were not paid a regular salary, though they usually were awarded some amount. They received the "venia legendi", authorizing them to lecture on a restricted branch of their geological studies. To be a Docent a prerequisite was the Ph.D. degree and an adequate literary activity. The docenture usually served as a step toward a professorship.

Although it was possible to learn geology and its related sciences, there was no special professional educational program for the training of geologists. These branches were taught within the curriculum for high school teachers of natural science. To qualify for a position with the Hungarian Geological Survey—private companies employed very few of them—there were the following possibilities: 1. to hold a doctor's degree with one major subject, and possibly also one minor subject in geology required for the ph.D. oral examination, 2. to possess a high school teacher's diploma for natural sciences, 3. to possess a mining engineer's diploma. Those—usually very few in number—who attended the lectures at the Technical University of Budapest, fulfilled their educational requirements by passing the Ph.D. examinations at the University of Budapest. The regular staff of the Hungarian Geological Survey was recruited principally from the first and second groups mentioned above, but after the First World War one of the principal requisites was to be graduated with the Ph.D. degree.

This absence of special education was caused primarily by the low demand for geologists. Private companies used geologists as consultants from time to time, and the staff of the Hungarian Geological Survey was not a large one. When it was necessary, the Survey entrusted members of universities and experienced high school teachers with temporary jobs. Before I was appointed to the Hungarian Geological Survey, in 1918, I had worked for it four summers, and later, when I left this job in 1937, having been appointed as Professor, I still worked for the Survey every summer. The Treaty of Trianon presented a really serious obstacle to the development of the Geological Survey by robbing Hungary of two-thirds of its area including the mountainous parts of the country with their mining districts. For seven years after I was appointed to the Survey in 1918 no new members were added to the staff, and some were discharged to adjust to the new restricted situation. Although in the early thirties there was some im-

provement and progress was made in building up special courses of study for geologists, these attempts were wrecked by the low demand, by the bad judgment of the authorities and by the failure of private companies to support the project by employing unemployed geologists who were available to them.

Consequently, each professor tried to do his best to educate better and better geologists, choosing them from his students who were registered in the courses for teachers of natural science but who possibly showed more aptitude for geology. Usually one or two of the students of my institute came with me or went with my Adjunct for special work during the summer vacation, for which they got not only some earnings but also the field experience. I always tried to follow this practice. For example, during my last years at home two of my students worked with me with plane table, etc. in the northeastern Carpathians studying conditions for a proposed dam. A second group, led by my Adjunct, worked on a projected canal, where the students had experience on shallow wells, leveling, investigations and laboratory studies on sediments. In addition each year I conducted a field trip lasting seven to ten days for all my students.

I always regretted that during my professorship the tensions before World War II, and later during the war years, made it impossible for me to take my students on field trips to foreign countries. I shall never forget the impressions given me by such a field trip to Italy, led by my old Professor, when I was a young fellow between my Junior and Senior years. I climbed all the active volcanoes. I saw the town of Messina only three years after its destruction by the terrible earthquake. We were in Pompeii. We visited the museums of Rome and Naples. All these things we saw during our 21-day trip, and thanks to the financial help we received from the state, we paid less than half the expenses!

It cannot be denied that a favorable change in the education of geologists developed after World War II. Backed by the Russian pressure for the development of the metals industry, special courses for geologists were introduced at the University of Budapest. At the other universities geology was still taught much as it had been, but since World War II a special diploma in geology has been awarded to those students who pass the special requirements in this subject.

Mr. Géza Kisvarsányi, who left Hungary after the events of October 1956, has told me of these recent developments. According to his information there are now the following professorships at the University of Budapest: 1. General Geology and Stratigraphy, one professor and four assistants; 2. Mineralogy, one professor and two assistants; 3. Petrology-Geochemistry, one professor and three assistants; 4. Economic Geology, one professor and one assistant; 5. Paleontology, one professor and four assistants; 6. Geophysics, one professor and three assistants. This geology sector was supported by a chemist, a photographic laboratory, draughtsmen, mechanics and a chauffeur. Another new development was the provision of laboratories for the divisions of Mineralogy, Petrology and Geochemistry with facilities for rock and ore microscopy, X-ray investigations, general sedimentary petrography, special petrographic studies of organic material, oil and coal, spectrography and crystal lattice studies, and a laboratory for the preparation of thin sections.

In the past, eight semesters work in geology were compulsory; the new curriculum requires nine semesters. This, however, includes no summer sessions. Each semester the student must pass an examination (called a colloquium) in each subject. At the end of the fourth semester he must undergo a comprehensive examination in mineralogy and petrology. After the sixth semester the student is given a month of field training, followed by examinations in general geology, stratigraphy, geochemistry and paleontology. At the end of the ninth semester come examinations in economic geology, technical geology and philosophy. It would be of interest to give here an entire schedule of the courses included in this curriculum, but my article would become too long.

I would like to mention, however, another type of geological education, the training of "geological engineers", now offered at the Technical University of Budapest and its faculty in the School of Forestry at Sopron. Many other universities have established new facilities, such as the laboratory for stress studies and weathering problems at the Technical University at Budapest, or the laboratory for radioactivity studies at the Institute for Mineralogy and Geology at Debrecen, etc.

Mr. Kisvarsányi estimates that during the period from 1949 to 1955 the number of students graduating in geology increased from 15 to 55, but declined to 40 in 1956. He believes that in 1958 and 1959 about 20 graduates will receive the special diploma in geology. This is obviously above the actual demand for geologists today in Hungary, but the Communist Regime has a solution for this problem: young geologists "volunteer" for work in Red China and other undeveloped countries behind the Iron Curtain. Possibly this accounts for the greatly increased emphasis on specialized education for geologists.

In spite of this great new development we must not lose sight of the good work done by the older generation which is reflected in the publications of the Hungarian Geological Society—an organization more than 100 years old—and of the Hungarian Geological Survey, whose first publication appeared in 1870.

## ARMIN K. LOBECK

Died, April 26, 1958 at the age of 70 years. Dr. Lobeck taught at the University of Wisconsin from 1919 to 1929 and at Columbia University from 1929 until he was made Professor Emeritus in 1954. He was a member of the Eastern Section of the Association of Geology Teachers and was a recipient of the Neil Miner Award.

JOURNAL OF GEOLOGICAL EDUCATION
Vol. 6, No. 1, Spring 1958, pp. 5-6

# GEOLOGY TEACHING AT THE UNIVERSITY LEVEL

C. G. HIGGINS
*University of California, Davis*

ABSTRACT. One of the chief goals of instruction at the university level—that is, at the postgraduate level—is to produce researchers. The qualifications of university teachers are the inclination and the ability to carry out independent research, while their actual teaching is characterized by a kind of stimulation-by-example which, in its particular situation, seems to work quite effectively.

The distinctive part of the university program—and the part we mean when we talk about "the university level"—is embodied in two aspects of university instruction, namely in postgraduate courses and in guidance of students' research. Some universities offer little or no postgraduate instruction in geology and therefore lack the special distinction—and problems—of the "university level." On the other hand, some "colieges" offer advanced degrees in geology. To the extent that such schools emphasize postgraduate instruction, they share the university level and, for the present discussion, may be called universities. In these postgraduate activities the university is fulfilling one of its chief functions: to produce researchers. It is this function and its effects that make the university situation somewhat different from that of other schools which duplicate some of the university's teaching program.

What sort of teacher do we need to teach students to become researchers? The traditional answer, given by the university, is that only a researcher can produce other researchers. The view is perhaps partly a rationalization of the university's desire for recognition as the home of outstanding scientists and scholars—another important function of the university. But whatever the reasons, the university is strongly research-oriented.

Consequently, the traditional *qualifications* of the geology teacher at the university are his inclination and ability to make significant original contributions to the field of geology. And his *preparation*, therefore, must be geared to provide him with these qualifications. This preparation for research would seem to have little to do with developing or encouraging teaching ability. How, then, can it produce, perhaps as a kind of by-product, teachers?

To answer this question we must remember that we are here considering the postgraduate part of the university's program. Strangely enough, although the caliber of postgraduate instruction varies considerably, it is generally far more effective than one would be led to expect from the teachers' preparation and general outlook. This is apparently because a research man who can be stimulated enough by a problem to seek an answer to it can somehow convey this stimulation to his students, like an induction motor or a transformer. Of course we must remember that these graduate students are a pre-selected group and are already sensitized to and expecting such stimulation toward research activity.

This is the most significant and distinctive feature of teaching at the university level. It does not require any great teaching ability, in the sense of the ability to awaken students' interest in a particular subject. It *does* require men who are, in the words of the Sigma Xi motto, "companions in zealous research." Students somehow seem to sense this, even from the most taciturn and cantankerous professors, and they, too, become zealous researchers.

The same attitude toward instruction and the same methods that work for the postgraduate courses may also prove very effective with some upper division classes at the undergraduate level. But they do not work well in the lower division, introductory courses. All too frequently the same man who can enflame a seminar or stimulate a doctoral candidate to a new approach to his research problem is a complete failure in the introductory courses because in these he must awaken or instill students' interest in the material he presents.

One solution to this problem is to hire special staff members whose whole assignment is to teach the beginning courses. Their preparation and interests are for teaching rather than for research. But this solution is full of difficulties and has been attempted in only a few schools, and in these without conspicuous success.

Generally, in any collection of university staff members, even prepared as they are primarily for research activity, one or more will show a flair for and a liking for teaching the introductory courses. He, or they, may be saddled with these courses, all too commonly until retirement, leaving the advanced courses for their more strongly research-minded colleagues. (The latter are just as deeply interested in teaching geology but their interests and special abilities lie chiefly in teaching advanced concepts in their own research fields. They are much less concerned with methods of presenting course material than with establishing mutually stimulating communication with graduate students. This difference in attitude toward, and approach to teaching on the part of most university staff members in geology probably accounts, to a large extent, for their general lack of interest in the program of the Association of Geology Teachers). Where such a division of labor can be arranged, the staff can most effectively pursue their course of casting students in their own images as research geologists or research geologist-teachers."

## MARCELLUS H. STOW

Died, November 27, 1957 at the age of 55 years. Dr. Stow was a member of the Department of Geology of Washington and Lee University, Lexington, Virginia since 1927, and had served as Professor and Department Head since 1942. He was a member of the Eastern Section of the Association of Geology Teachers.

JOURNAL OF GEOLOGICAL EDUCATION
Vol. 6, No. 1, Spring 1958, pp. 7-10

# RESEARCH IN GEOLOGY

LLOYD W. STAPLES
*University of Oregon*

ABSTRACT. The problem of what constitutes research is one that is being given great attention today, due in part to the international armament race. It is difficult to distinguish between technology and research in general, and this problem is encountered in geology. How much of field mapping can be considered fundamental research? Is field mapping for commercial groups to be considered significant research? In order to have donors of awards for research recognize geology as a proper field of research, it is necessary that geologists themselves clearly define the limits of what they consider to be significant geological research.

Scientific research has gained great popularity recently chiefly due to our attempt to attain and keep a position of leadership in the armament race. Before the general public became aware of the practical results of research, industrial organizations had found it advantageous to return a substantial part of gross income to research activity for the development of new products. Along with this has come research into marketing problems, plant location, and employee relationships. Industrial research and development in the 1929-1954 period jumped from 160 million dollars to four billion dollars annually. This latter figure represents about two-thirds of the total national expenditure for research and development.

With the extensive application of research to many fields it is not surprising that there have arisen many definitions of research and a wide variation in the concept of what constitutes research activity. Each field must attempt to define and delimit the concept for itself. Unfortunately, persons who are in a position to award research grants or who must evaluate research for the purpose of making awards, often do not have a clear concept of what constitutes significant research in fields other than their own. This is particularly true when research in geology is being judged by scientists from other physical sciences in which quantitative data may be used to a greater extent. Part of the difficulty is that geologists themselves have not given this matter careful consideration and although it may be asking too much to expect unanimity in agreement on the confines of significant research in geology, a study of the matter suggests some possible solutions to the problem.

## WHO DEFINES RESEARCH IN GEOLOGY?

What constitutes research in geology is determined, in part, by at least four groups of people, representing administration in very different areas. These people represent (1) universities in their graduate dissertation requirements, (2) foundations and scientific societies, such as the National Science Foundation, Geological Society of America, that make grants for research, (3) periodicals containing geological papers, (4) government agencies and other groups with publishing facilities (5) industrial organizations and universities where publication in part determines advancement in rank. A brief comment on these seems appropriate.

Doctoral dissertation requirements vary as much with the school as the resulting value of the Ph.D. degree. Formerly some schools permitted partial fulfillment of the degree requirements with the completion of a quadrangle study, including a geologic map. Most universities have demanded that there be a significant problem in the area requiring special analysis. There now appears to be an increase in research devoted to the solution of specialized problems often requiring expensive equipment and a broader knowledge of physics, chemistry, and biology. This shift has been accelerated by the trend toward specialization and the financial aid from research grants.

The Geological Society of America makes research grants for investigation which will contribute to "the promotion in North America of the science of geology." The distribution is interesting. For the years 1933-1957, vulcanology has received 2.5 per cent, economic 2.5 per cent, mineralogy 4 per cent, geophysics and geochemistry 11 per cent, petrology 17 per cent, paleontology 25 per cent and general studies 38 per cent. It is also interesting that the G.S.A. is giving increasing attention to grants-in-aid for Ph.D. candidates, and therefore may have an influence similar to the degree granting institutions on dissertation research.

When the quantity of research being completed is large and consequently periodicals have a large backlog of unpublished papers, the editorial staffs exert a great influence on what is acceptable research. This is keenly felt under circumstances such as those of faculty members in institutions which have a "publish or perish" policy, thereby influencing some members to tailor their research to a form that will receive earlier publication. The influence is in part good and part bad; good in that the research report must be cut down to essentials, sometimes bad in that the paper may be too severely restricted in material, and some less popular areas of geology may not find vehicles for publication.

If government agencies have a free hand in choosing their research, this research can be a major source of outstanding contributions. It has been shown recently that only 8 per cent of the Federal Government expenditures for research and development went into basic research. With past budgets of 3 billion dollars, and probably larger ones in the future, the effect of Federal supervision on the direction and type of research is clearly evident. It is somewhat encouraging that 300 million dollars of Federal funds is earmarked for pure research this year, but the designation of areas to be studied is not completely satisfactory. Proposed curtailment of the research activities of the U. S. Geological Survey is especially to be deplored.

In the case of universities, even more often than in other organizations, the persons assigned to study the productivity of the staff often are members of a committee or group whose training is not broad enough to evaluate properly the results of the research. This leads writers to such undesirable practices as "padding" of papers when it is known that the number of pages is used as a criterion of merit, or publication of numerous short articles to obtain bibliographic titles, with the hope that these will be counted without being carefully evaluated. In the same category is the publishing of abstracts without subsequent completion of the research and publication. In cases where an evaluating person or group is

not qualified to judge the value of research, the task may be referred to a geologist and the question raised as to what constitutes valid and fundamental geological research.

## THE DEFINITION OF RESEARCH

At the 1957 meeting of the G.S.A., the Association of Geology Teachers held a symposium on research and teaching in geology. In none of the papers was a careful attempt made to define research in geology, but it was evident that some of the authors defined research in a very general way.

As a starting point we may agree with Webster's definition of research as "A critical and exhaustive investigation or experimentation having for its aim the discovery of new facts and their correct interpretation." Also we may accept, "The revision of accepted conclusions in the light of newly discovered facts."

Beyond these concepts there are cases that become more and more debatable. Some might include the mere compiling of already published facts, the walking of outcrops, the simple projection of an ore body requiring only surveying, and many other such examples.

For the sake of discussion we may consider research in either of two ways, (1) any activity that adds to knowledge, (2) contributions to knowledge which are published, communicated, or applied significantly. The first definition is so broad that many activities, such as field trips, would be included although usually they would not be considered as significant research. The second definition may be accused of being too restrictive, but it is more nearly what is understood as fundamental research by groups who make awards or promotions. This type is usually indicated as "significant," "fundamental" or "basic," and is the only type worthy of the name. Publication acts as a screening process, the fineness of the screen being consistent with the quality of the journal. What about the work of geologists which goes into company files instead of being published? According to the above definition it would not be considered significant research if it never were used. If, on the other hand, it is used so that the results become available or benefit others it may constitute research even though not published.

We may classify most geological research activities as follows: (1) laboratory studies, (2) field collecting with subsequent laboratory classification and description (3) the development of general hypotheses, (4) bibliographic compilations, reviews, and analyses, (5) field studies including geologic mapping. Each of these may qualify as research to different degrees, depending on whether the activity is merely mechanical or whether it involves creative activity. Laboratory studies are most readily accepted as significant research because the results are easily tested and evaluated. For this reason, work in paleontology, crystallography, geophysics and geochemistry, for example, can often secure research grants more readily than some abstract research. It is interesting that four of the first six recipients of the Mineralogical Society of America Award did work on hydrothermal synthesis and the other recipients were primarily geochemists. It is much more difficult to evaluate research on the origin of island arcs, metallogenetic provinces, or continental drift than on those problems that can be stated quantitatively as the result of readily repeated laboratory studies.

Geologic field mapping is an activity confined to geologists and as such presents a special problem. Whether it should be classed as significant research is of great importance to geologists, who consider the field as their laboratory. Unfortunately, other scientists are not aware of the details of geologic mapping and interpretation, and often show very little appreciation for what they consider only a colored map, not to be compared with a scientific paper as significant research. This matter was discussed, both seriously and facetiously in a series of communications in the A. G. I. Geological Newsletter (1954-56). Like other investigations, field mapping may or may not qualify as significant research, depending on the scientific problem and method of attack. There is no doubt that field work including careful mapping, proper interpretation, and published in acceptable fashion constitutes a significant research activity. The same cannot be said of the mere plotting of contacts. This view was clearly expressed by Gray in Geotimes (Vol. 1, p. 16, Nov. 1956) who stated that "Most geological research requires a basis of field work but all field work is not research." To be significant as research it must act as the basis for drawing new conclusions or arriving at new ideas. Obviously, a map buried forever in the company file does not fill these specifications. It is important that geologists strive to have the results of their field studies awarded the same recognition as laboratory studies, each problem being judged on its intrinsic merits, dependent on how much it adds to our knowledge.

In the case of the teacher, the problem arises whether his activities can qualify as research if they make him a better teacher. According to one viewpoint, the teacher who tours the National Parks is doing a type of research because he is making observations that he will impart to his students. This becomes a matter of degree, and to the extent that the observations are uncovering new facts and that he is able to disseminate this information, it may qualify as research. Obviously, it is unlikely that he would make any profound discoveries or distribute the information very far, so it would not qualify as very significant research, even though it might be of value to both the teacher and student.

It should be noted that the actual finding of new facts may not be necessary in research. Many a person has done a diligent research job but ended in a blind alley, the negative results sometimes being only a little less valuable than positive ones. The requirement of publishing or communicating these is still necessary if the work is to fulfill the requirements of adequate research.

In conclusion, there is the broad concept of research in geology which includes all activities contributing to a knowledge of the subject. A more limited but meaningful definition demands actual creativity rather than the mechanical collecting or tabulating of data. The writer prefers the latter more limited definition with the added stipulation that the knowledge gained must be transmitted to fellow scientists in order that it may become a building stone in the structure representing the results of the search for truth by all other scientists.

JOURNAL OF GEOLOGICAL EDUCATION
Vol. 6, No. 1, Spring 1958, pp. 11-14

# TEACHING AND RESEARCH: IMMISCIBLE COMPONENTS OR ISOMORPHOUS SERIES?

IAN CAMPBELL
*California Institute of Technology*

ABSTRACT. Two answers are extant: (1) teaching and research do not blend, and any attempt to achieve a blend results in a mixed-up individual who inevitably will impart his frustrations to his students; (2) teaching and research theoretically and practically do blend in all proportions, and the only problem lies in what proportions are best. The circumstance that in teaching-and-research, just as with mineral isomorphous series, "pure end members" rarely occur, is only one of several features that support the second answer. More important is the fact that within any random group of sufficient size, one or more individuals can be found whose proclivities may be designated as $Te_{95}Re_5$ (Te = teaching; Re = research), while others will be $Te_{90}Re_{10}$, and so on—to some who will exemplify $Te_5Re_{95}$. What a college needs in a staff appointee will depend on the objectives of the school and the level of training. Thus for teaching freshmen a basic discipline such as mathematics, perhaps a $Te_{90}Re_{10}$ is best, whereas for guiding PhD programs in geology, a $Te_{10}Re_{90}$ will be preferable. Studies might well be undertaken to determine the degree (if any) to which, by varying the P-T-X conditions (the total environment), it may be possible to alter the natural Te-Re ratio within an individual. Development of a successful procedure for accomplishing this would provide flexibility for faculty groups facing changing demands in education.

*Prologue.* Those who perchance read both abstract and text will note an astonishing lack of correlation. I could have spared the reader his dismay and myself considerable embarrassment, had I prepared a new and different abstract. But I prefer to let this abstract (as originally published in the GSA-AGT program for the Atlantic City meetings) stand as an interesting example on the one hand to those more kindly disposed, of evolution in thought; and on the other hand to those more critically disposed, as a horrible example of what can happen to a man who has the temerity to file an abstract before he has written the paper.

* * * * * * * * * * *

This contribution to the AGT symposium, I will freely confess, started as a bit of whimsey on my part in responding to Bob Bates' initial invitation to participate. I had suggested, with my tongue in my cheek, and thinking this would let me out of the program, an analogy between teaching and research and an isomorphous mineral series. To my surprise, Bob called me (perhaps he also had his tongue in his cheek!) and so the paper developed, albeit along lines somewhat different from those originally envisaged. Be this as it may, I felt—and still feel—that there may be an analogy, and that it will provide a stimulus for thought and discussion.

Let me outline the analogy as I first saw it. We are well aware how rarely a "pure end member" is to be found in isomorphous mineral series. The same may be true in a teaching-and-research series. I doubt that there exists a pure, 100 per cent teacher, undefiled by even a small spark of research. Similarily, I doubt that the most fully dedicated researcher lacks at least a spark of the teacher. We know, too, that men have to go to great lengths, employing the utmost pre-

cautions, in order to synthesize the pure "end components" of minerals. Doesn't this also suggest an analogy with people? Were we to try to develop a "pure researcher" or a "pure teacher," would we likewise not have to go to great lengths? If accomplishable at all, wouldn't it only be through subtle and sophisticated procedures: educational, psychological, and—now perhaps just around the corner—chemical? But the best analogy, it seemed to me, is that amongst individuals we can find representatives of almost every possible mixture of teacher and researcher, from $Te_{99}Re_1$ to $Te_1Re_{99}$.

Whether analogous to an isomorphous series or not (a point I shall return to), what is more immediately important to us, is the distribution of these components in our academic-geologic population. It is a Gaussian distribution—a bell-shaped curve with the clapper of the bell dangling over the 50-50 point; or is it a curve significantly skewed toward one end or the other; or is it perchance a double-peaked curve with the peaks near the two ends and a discouragingly low spot in the middle? I say "discouragingly low" for here is where colleges facing the problem of recruiting new staff would like to find a broad and high plateau, with its assurance of ample numbers of individuals to draw upon. (I am assuming that it is almost a truism that most geology faculties would like to take on men who are about equally competent and productive in both teaching and research.) Do we really know anything about this distribution curve? I don't; I doubt that anyone else does; I doubt that measurements have even been designed that would yield an acceptable answer. Perhaps it is high time we started some studies along this line.

At this point, let me interject another confession. I wrote and filed the abstract before I had given any real thought to the preparation of the paper. To be sure, this is common practice among geologists who are required by the GSA to submit abstracts in June for an oral presentation to be made in November. But in this case, my crime has caught up to me, for I hadn't even, at the time of submitting the abstract, done much of the "field work" for this discussion. Subsequently, I have found that such light as psychology can throw on this problem of distribution of Te and Re, suggests that, contrary to my preliminary assumptions from a rather rough analogy between men and minerals, teaching and research are more probably nearly immiscible components. Psychologists are of the opinion that the motives (chiefly subconscious) which impel a man toward teaching are largely incompatible with those which impel a man toward research. Teachers are so motivated because basically they are fond of people. Their own parental relationships have been such that they seek the role of parent—parent to many children! The research man, by contrast, is one who wants to be alone—alone with his research. I know that this is much too broad-brush a treatment of a very complex matter. But in order to keep the paper within its allotted time, only generalizations can be submitted—generalizations to which many exceptions must be obvious.

But if these generalizations be even approximately true, then the possibilities, for example, that a man whose bent is for teaching, can develop—or be developed—into a keen researcher, or vice versa, are slight indeed. Parenthetically it might

be added that, in the opinion of some psychologists, there occasionally are circumstances which in some researchers might develop a real and effective interest in teaching; whereas the reverse would almost never be true. Some very delicate and interesting experiments in neuro-surgery[1] have led recently to the suggestion that "brain patterns" may already be set when chromosomes first link—that is to say, the patterns are determined by heredity, and subsequent environment and changes in environment can have little or nothing to do with "brain potentials" or "brain directions." Along with this thought it is interesting to note the comment from another biologist that "the possibility of being able to alter the heredity of living organisms by deliberate chemical modifications does not seem nearly as visionary as it did only a few years ago."[2]

What does all this mean for the training of geologists? It means, I think, that for the present we had best accept teacher and researcher for what they are, and not try or hope to change them. It means, too, that we—or more properly perhaps, the psychologists, or both of us together—should give serious study to the problem, not only of the distribution curve, but to the possibilities of improving the distribution if we find it not best suited to our future needs. Essentially it means that as natural scientists we should take pride, as we always have, in devising ways to utilize our present natural resources to the fullest, while at the same time seeking means of improving them, and of developing new resources —natural and/or synthetic.

Most geology departments are today no longer one-man departments, and with the increasing college enrollment that is already upon us, departments inevitably will grow larger. If the man who can successfully combine careers in both teaching and research in equal degree is, and for the forseeable future will continue to be, in short supply—indeed there never have been enough of these exceptionally gifted individuals to go around—let us not be discouraged or dismayed. Let us see that our geology faculties, if they cannot all be $Te_{50}Re_{50}$s will be staffed with a judicious mixture of $Te_{90}$'s and $Re_{90}$'s and whatever else in the range we may want to draw upon.

To sum up (I cannot say "by way of conclusion"—since no firm conclusions deserve to be drawn from the data presented) it is clear that the field evidence—recognition of the many individuals who successfully combine teaching and research —is in conflict with psychological theory. As in all such situations, further study is needed. And in this instance, it is sorely needed, if we are to meet the challenge of making the most of our scientific manpower resources.

* * * * * * * * * * *

*Epilogue.* Orally at the symposium, and subsequently in letters from several colleagues, the suggestion was put forward that my two-component, Te-Re analogy was over-simplified, and that at least one or two, if not indeed several, components

---

(1) R. W. Sperry, Brain Mechanisms in Behavior; Engineering and Science, 20 (8), 24-29, 1957.

(2) Dean Fraser, as quoted (p. 16) in "Basic Research: A National Resource"; Nat. Sci. Foundation, 1957.

should be added to make the system more realistic: in particular, "Ad" for administrative responsibilities, and "Co" for committee assignments. My comment to these very pertinent suggestions is that, as components are added to a system, the melting point is lowered, and—depending on confining pressures, gas content, etc.—there results increasing danger of a blow-up on the part of an otherwise "solid citizen"!

---

## TREASURER'S REPORT

| | | | |
|---|---|---|---|
| **CREDITS** | | | |
| Balance brought forward, January 24, 1957 | | | $ 659.34 |
| Income, 1957 | | | |
| JOURNAL OF GEOLOGICAL EDUCATION Sales | | $ 507.75 | |
| JOURNAL reprint orders | | 18.05 | |
| NATIONAL DUES | | 898.50 | |
| DONATIONS AND INTEREST | | | |
| Horberg Memorial Fund | $ 325.00 | | |
| Interest on Horberg Fund | .45 | | |
| Eastern Section Gift | 150.00 | | |
| East Central Section Gift | 50.00 | | |
| Southeastern Section Gift | 20.00 | | |
| | | $ 545.45 | |
| TOTAL INCOME | | $1969.75 | 1969.75 |
| TOTAL CREDITS, as of January 24, 1958 | | | $2629.09 |
| **DEBITS** | | | |
| JOURNAL OF GEOLOGICAL EDUCATION | | | |
| Volume 5, Nos. 1 and 2 | | $1088.36 | |
| OFFICERS' EXPENSES | | 230.39 | |
| MISCELLANEOUS EXPENSES | | | |
| Horberg Fund: Four $100 Series F Savings bonds at $72.00 plus savings account for balance | | 325.00 | |
| AGI dues for 1957 (10% of $802.50) | | 80.25 | |
| Refund on dues and subscriptions | | 11.60 | |
| Bank charges | | 2.41 | |
| TOTAL DISBURSEMENTS | | $1738.01 | 1738.01 |
| BALANCE on hand, January 24, 1958 | | | $ 891.08 |

Respectfully submitted,

John Eliot Allen
*Treasurer, 1957*

JOURNAL OF GEOLOGICAL EDUCATION
Vol. 6, No. 1, Spring 1958, pp. 15-18

# RESEARCH AND EFFECTIVE TEACHING IN THE GEOLOGICAL SCIENCES

BYRON N. COOPER
*Virginia Polytechnic Institute*

ABSTRACT. Some geology teachers spend practically all their time and professional energies being teachers; others are so engrossed in geological research that they are incapable of communicating with students at any level of training. Most teachers of geology would be classed between these extremes, and many possess a reasonably good balance between research activity and teaching. Although obviously valuable to the teacher of geology, research activity possesses only relative values. It is difficult to determine when a teacher does too much or too little research or whether the research is bad or mediocre or good.

Despite its equivocal nature, research activity is the soundest criterion for determining that a geologist is professionally alive. It indicates some degree of scientific motivation and competence. Research work provides a fountainhead of enthusiasm every teacher must have to be truly effective. Particularly on the graduate level of instruction, a teacher's reputation in geological research tends to draw outstanding students who in turn inspire the teacher to achieve maximum effectiveness.

More important than attainment of ideal balance between research and teaching activities within each staff member is the attainment of nearly ideal balance in the departmental teaching staff as a whole. Geology teachers need to resist administrative attempts to force all teachers to conform to any prescribed pattern of teaching and professional activities.

No doubt, a few teachers of geology are good teachers in spite of the fact that they carry on no appreciable amount of geological research. I am even more positive that some geology professors consume so much of their time in research and in the readying of papers for publication that virtually none is left for organization of class discussions and lectures. Let us avoid discussion of these extremes.

Most geology teachers put professional activity ahead of teaching, as is reflected by the fact that nearly all of us think of ourselves first as geologists and only secondly as teachers of geology. Geology cannot be a spectator science; one has to work at geology to understand it. The mutual stimulation and general enthusiasm aroused by research activity tends to keep the teacher of geology young in heart. The natural, radiant enthusiasm of the research-minded teacher helps to kindle motivation in the capable student and even enables him to break down the diffidence and apathy of the poorer student. Such enthusiasm arises from the teacher's mere engagement in research activity and is not dependent upon publication of the results. As a matter of fact, the labor of readying a paper for publication and of seeing it through the editorial mill is for most of us rather unrewarding drudgery. The fatherly pride one is supposed to enjoy when a piece of his research is published is a myth. Many of us engage in investigative or research activities that do not always permit or necessarily require formal publication. For a teacher, most of the values that accrue from research done on a geological problem exist whether or not there is eventual publication.

Research activity forms a pathway to achievement of a deeper insight into fundamental geological theory. The geology teacher involved in research work is

constantly revising his visualization and appreciation of geologic processes and as a result gains an ever deepening understanding of the principles governing them. All of this makes him a more effective teacher. Participation in geological research enables a teacher to enliven his presentations of course material with specific personal experiences and observations so that what he teaches is not cut and dried.

An effective teacher must instill a large measure of scientific humility in his students. He cannot do this if he is highly opinionated. Absolutely fixed ideas in our science are dangerous. Research activity goes a long way toward keeping one in the right frame of mind to recognize and comprehend new ideas and communicate them to students.

Research activity provides the impelling force that makes us keep up with the literature at least in our own special fields. Today we are in the midst of a series of great shaking revolutions in geologic thought. Basic ideas are constantly changing. Many current concepts of stratigraphy, paleogeography, paleontology, geomorphology, orogenesis, sedimentation, and metamorphism are very, very young. An effective teacher cannot afford to wait until a new interpretation creeps into textbooks before discussing it with students. The effective teacher is compelled by the rapid evolution of thought in his field to read and read and read, if he is to offer his students up-to-date ideas and points of view. I believe that when research activity ceases to be a part of the daily or weekly regimen of a geology teacher the principal incentive for keeping up with the literature of his science has been taken away, and he begins to go downhill as a teacher.

All of these benefits accrue just from doing research, regardless of whether the work is eventually published. Add to these desirable benefits the additional rewards dependent on publication of research, and the professor's effectiveness as a teacher is further advanced. Publications give the teacher standing within the group of geologists engaged in his specialty. People begin to seek him out. Additional knowledge comes to him as a result of reactions aroused in other geologists concerning his published work. In due course he may come to be recognized as one of the leaders in a field of investigation.

When this happens the gravitation of serious-minded students toward that professor is inescapable. The old cliché about "build a better mousetrap" certainly holds true. The professor who has an established research reputation is assured of contact with a more select group of students who purposely come to him for what he has to offer them. The 1957 Penrose Medalist, Professor Bruno Sander, laid out in a series of papers published over a 20-year period beginning about 1911 the framework for a new branch of the geological sciences. His writings transcended the barriers of geography and language and attracted a continuing flow of "students" to his laboratory at Innsbruck, Austria, which came to be recognized as the world center for the study of structural petrology. Solid, though not necessarily so spectacular, reputations in specialized fields of geological research, possessed by members of a geology staff, can be powerful attractions that influence high-caliber students in their choice of a graduate school.

Teachers benefit as much from association with outstanding students as the students gain from associating with effective teachers. The enlivening influence of fresh enthusiasm which radiates from good students eager to learn inspires the professor in the classroom, laboratory, and field. Association with good students keeps the professor on his toes and impels him to do his best. Thus, the published research of a teacher by drawing to him a superior caliber of student contributes as a feed-back to his effectiveness as a teacher.

May I mention just one additional and somewhat different observation concerning the relation of research to effective teaching in the geological sciences. Few of us can expect to achieve, much less maintain, a happy and ideal balance of research activity and teaching. University people are seldom balanced in talents. Some quite naturally prefer to do more research and less teaching. Others cannot resist the appealing temptation to spend more and more time with students at the sacrifice of their time otherwise devoted to research. The former are apt to regard teaching as somewhat of an imposition at times; the latter may, on the other hand, regard time required to complete a piece of research as detrimental to instruction of the immediate moment.

The number of strong departments of the geological sciences is multiplying rapidly and in each department the number of staff members is increasing steadily. One-man departments are passing out of the picture; twenty-man departments are emerging. With the advent of enlarged staffs and increase in diversity of departmental talent it can only be expected that individual staff members will depart more and more from the ideal individual balance of research activity and teaching, which used to be a desirable objective. Large staffs make it possible to accommodate geologists with highly specialized talents whose principal contribution to their department is the research, rather than the teaching, that they carry on. Emerging from these larger and more diversified departments will come students who have had contacts with different kinds of professors, some of whom are both top-flight researchers and excellent teachers, some excellent teachers without having outstanding reputations in research, some of whom are skilled researchers but not very successful teachers, and perhaps a few who are successful teachers and little else. So far as the student is concerned, the effective instruction he receives in such a department will become more a matter of general department achievement than identifiable results of the influence of individual teachers. A good graduate education in geology consists not only of high-level instruction in geological theory but also in opportunities for serving an apprenticeship of observation of and active participation in field and laboratory research projects of staff members. Research alone cannot make a department of geology great; research only helps to make effective teaching easier for a department to achieve. Nothing imperils effective teaching in the geological sciences any more than the research factory type of departmental atmosphere.

College and university administrations have already overused the research accomplishments of staff members in evaluating their qualifications for advancement in salary and promotion in rank. Effective teaching is a more subtle accomplishment and is more apt to go unnoticed by administrative eyes and ears. De-

partments of geology should resist any and all administrative efforts which tend to evaluate teachers on the basis of any arbitrary set of standards. Otherwise the researcher is bound to be rewarded and the man who is primarily the teacher will be overlooked or forgotten.

Departments of geology will have to struggle to maintain overall balance between departmental research activities and teaching. The larger the departmental staff, the greater the risk of losing sight of the main educational objectives of a university. In the future, just as at present, the type of person most needed to insure departmental effectiveness in the teaching of the geological sciences is the teacher that will be hardest to find and the easiest to overlook and ignore when promotions and salary raises are awarded—and that is the research-minded geologist who loves to work with students and who is inclined at times to sacrifice his own research productivity temporarily in the interests of his students. Let us not allow him to become the Dodo Bird of our profession!

---

*Reversible Barchans.* U. S. Geological Survey, Quadrangle Maps: Moses Lake, Wash., 1:62,500; Mae, Wash., 1:24,000.

Since publication in 1912, the Moses Lake sheet has been used in map interpretation work in many geology departments, to demonstrate the appearance of barchans on contour maps. In the southwest part of the map about 30 barchans are clearly defined by closed contours of crescent or banana shape, all oriented to indicate a prevailing wind from the west-southwest.

Distribution of the Mae sheet in 1957 permits examination of the same area in greater detail, as mapped 45 years later. As would be expected, the barchans of the older map are no longer identifiable. Quite unexpected, however, is the fact that the new barchans are oriented about 180 degrees at variance with the older ones!

I leave to the fertile ingenuity of all geology teachers the appropriate explanation for this remarkable phenomenon.

A. SCOTT WARTHIN, JR.
*Vassar College*

JOURNAL OF GEOLOGICAL EDUCATION
Vol. 6, No. 1, Spring 1958, pp. 19-21

# SOME RELATIONSHIPS OF TEACHING AND RESEARCH IN GEOLOGY

GROVER E. MURRAY
*Louisiana State University*

ABSTRACT. Instruction of undergraduate students in geology involves the impartation of (1) historical information pertaining to the science, (2) current ideas and facts, and (3) knowledge of how to apply this information or how to do things. Graduate education places emphasis on research, an essential part of the overall program being the seminar, and requires a considerably greater degree of specialization and the experience of the instructor. As the majority of all these students are trained for the practice of a profession rather than for ivory-tower positions, it is mandatory that instructors be competent in all phases of geology.

Broadly speaking, geologic research is any effort which develops or contributes knowledge to the discipline, and, therefore, to the various aspects of teaching. Familiarity with literature and texts may permit excellence of instruction in certain survey and factual data courses but it can not develop the competence or specialization which is achieved through research experience, applied or otherwise.

A poll of 2,200 graduate students at Louisiana State University in 1950-1951 categorized 65 professors in widely separated fields as *best teachers*. Forty-six per cent of these men possessed a record of continued productivity in scholarship and research. Another 16% showed occasional productivity. Sixty-seven per cent of the selected group had research in progress as against only 40% of the faculty as a whole, including the *best teachers*. These statistics imply that productive researchers are more likely to be good teachers than colleagues who are less active in research.

The necessity of doing research in order to teach well seems so obviously apparent as to preclude any argument in the matter, although I am well aware that it has often been said that a man is either a good researcher or a good teacher. There are certainly exceptions which prove the rule in each instance. Personal experiences convince me that the average good professor is first a good geologist and second a good teacher. The research efforts and the successful students of certain universities and colleges in both this and other countries stand as mute testimony in the matter.

Teaching geology involves the transmission or impartation of knowledge and the guiding, encouraging or inspiring of students to learn and to investigate for themselves. It concerns principally the training of students for *practicing a profession rather than for ivory-tower positions, as only a relatively small percent of students will enter the teaching profession.* For capability in this type of student training, a professor must know *how to do* things, as well as *what has to be done.* On the other hand, research in geology, and I take a broad view of it, is any investigation or effort, pure or applied, remunerative or non-remunerative, which contributes to knowledge in our science.

Geological courses rather naturally fall into two categories of instructions: (1) basic, factual survey courses, primarily undergraduate in nature, and (2) somewhat more interpretative, upper under-graduate and graduate courses.

The first group involves an appreciable percentage of factual and historical material, and, without question, these courses may be taught superlatively by one able to communicate well. In certain of these instances, active research or investigation on the part of the instructor is not a necessity.

As upper-classmen and graduate students expand their knowledge, it is increasingly important that they learn the principles of investigating, recording, analyzing, synthesizing and presenting data. Research, either by an instructor with student participation, or by a student with faculty participation and guidance, accomplishes this result and, additionally, benefits both parties but, most of all, stimulates interest. This approach is a universal and basic requirement of graduate programs throughout the world. Without the familiarity with a particular subject which is gained only by disciplined personal observations, a professor cannot hope to inspire confidence in his students in these instances.

It is inconceivable that a professor could teach anatomy successfully, for example, if he had not spent time dissecting cadavers and learned their structure in detail. Familiarity with texts would not be enough. The geology professor is in a similar position. A teacher of general geology must be able to identify numerous minerals, rocks, structures, topographic forms, and so on, in order to teach about them with assurance. A specialist must know much more within his immediate field. Neither can be really competent on the basis of literature investigation alone. For the understanding of publications, or even elementary texts, a person must have a familiarity with the subject that can be gained and maintained only through personal investigation of the subjects under consideration —that is, through research and investigation. And in this connection, it seems there is probably less excuse for a geologist to be uninterested in research than for practically any other faculty member, for even without elaborate library or laboratory facilities, he is bound to have unsolved and interesting problems not far from his office or home.

At Louisiana State University, where it is possible, under certain conditions, to obtain the Master of Science degree without a thesis (but not without some research), we see a definite relationship between research activity and good students. An appreciable majority of our better students take degrees with men actively engaged in research. It may be said this merely indicates that good students recognize the value of such an approach, but numerous cases are on file of students with previously mediocre records who caught fire because of research activities or investigations and subsequently made good to superior academic records.

If research programs are essential for the procurement of graduate degrees, and I do not know of anyone who challenges this dictum, it would appear necessary for teachers to maintain some sort of research program or investigation to assure their continued training and development.

No department of geology should devote its efforts entirely to research but I do strongly agree with Dean C. A. Elvejem of the Graduate School, University of Wisconsin, when he says, "A combination of teaching and research gives greater assurance that what I teach is true."[1]

---

(1) Proc. Research Planning Conference, Green Lake, Wisconsin, September 10-13, page 19.

Research programs for individuals will vary, as no two of us are exactly similar, and there are no magic formulas. I personally believe that an average somewhere in the neighborhood of 75 per cent teaching to 25 per cent *research or investigation* is about right for the academic year. During summers, 100 per cent research and investigation, subsidized or otherwise, is desirable. Such a change of scenery may take numerous directions even to the point of full time commercial employment. Basically, except for the publication angle, is there any real difference in measuring sections or in making paleontological zonations of the Cretaceous for pay, as against doing it "just for the heck-of-it?"

My point is—geological research is a broad thing and includes a great variety of different kinds of work with innumerable goals. It is not necessary for a teacher to knock himself out trying to publish reams of material, but I do believe *it is absolutely essential that he engage actively in geologic investigations,* whether you call it research or not, and thus maintain his status as a geologist.

In partial substantiation of this thesis, I submit the results of some statistical investigations made by R. J. Russell, Dean of the Graduate School, Louisiana State University, which were developed in connection with the university's training program.

A poll of 2200 graduate students at Louisiana State University in 1950-1951 categorized 65 professors in widely separated fields as best teachers. The figures were obtained from a questionnaire which, after a preliminary statement that the poll was not a popularity contest, asked the students to list the *best-taught* and *second-best taught* courses taken as undergraduates and the *best-taught* course taken as a graduate student.

The 65 best teachers were each "cited" ten or more times and I assume, as did Dean Russell, that these persons must be regarded as successful teachers. These results may not be really significant but they are certainly interesting. The records of 63 of these 65 good teachers were further investigated by Russell, based on up-to-date research inventory files maintained by the University.

Forty-six per cent of these good teachers possessed a record of continued productivity in scholarship and research. Another 16 per cent were occasionally productive. Sixty-seven per cent of these people were currently engaged in research as compared to an average of only 40 per cent for the teaching faculity as a whole, including good teachers. These figures hardly substantiate the statement that faculty members are either good teachers or good researchers.

JOURNAL OF GEOLOGICAL EDUCATION
Vol. 6, No. 1, Spring 1958, pp. 22, 23

# SCHOLARSHIP IN GEOLOGY

WILLIAM R. THURSTON
*National Academy of Sciences—National Research Council*

ABSTRACT. Research and teaching are inseparable—scholarship covers both. Institutions of learning, industry, and government all have contributions to make to the promotion of more and better teaching so that all scholarship may be benefited.

The lesson for today's sermon is taken from the report by F. W. Strothman, *The Graduate School today and tomorrow*, written on behalf of the Committee of Fifteen: Fund for the Advancement of Education, 655 Madison Avenue, New York, published in December, 1955, beginning on page 17.

"Close analysis always reveals the artificiality of the alleged conflict between 'teaching' and 'research'. Our Committee regards 'learning' and 'teaching', or 'research' and 'publication' as two phases of one activity: the life of the mind.

There are . . . not scholars and teachers, but gradations and mixtures of ability in research and in the mode of communicating its results. Every good teacher must be trained in his discipline and must keep up with its literature. Otherwise he is no teacher but a drill master coasting on his memory of early learning days. And every good scholar owes it to himself and his (profession) to share his acquirements, old and new. A man who can do research and think is in no borrowed sense a productive scholar if he 'publishes' his results annually by word of mouth to a group of students . . .

. . . the contrasting types are not 'teacher' and 'scholar' but teaching scholar (or scholar-teacher) and writing scholar . . . For the whole duty of man as scholar is to find out new truth and to impart it. Ideally, . . . the complete performer can study, think, teach, and write; in practice, we must be content with the combinations of talents that Nature provides."

Teaching and research are an indivisible pair and it is unimportant which originated first. I take the position that teaching precedes research—if we do not have good teaching today, we will lack both teachers and researchers tomorrow. The advancement of both facets of scholarship is not an internal problem for schools and teachers alone to consider. Industry and government are also dependent on promoting a more productive interrelationship.

What can be done about the interplay between teaching and research, so that we may get better quality and larger quantity of both? I have not heard of a radically new solution and I propose only that we enlarge the scope and increase the effectiveness of orthodox practices. Each of the interested parties—institutions of learning, industry, and government—has a contribution to make.

Teaching assistantships are certainly not new but I submit that they could be made more widely effective devices for teaching and also for recruiting teachers. Whenever possible, the available assistantships should be awarded to men who might follow a teaching career. Pay a stipend commensurate with the services rendered; and to make the most of the services rendered, the responsible professor should give systematic guidance and friendly supervision throughout the course. A young man floundering through his assistantship is not likely to make geology interesting to his class nor is he likely to be attracted to teaching as a career. Some schools have reputations for good assistantship programs—let's have more.

Academic institutions do not have *all* the good teachers. There are many among the research men in industry and in government. At some schools it is an accepted practice to have government and industry scientists do some teaching. My impression is that the practice is quite limited, but whether limited or not, it could be expanded and improved. Scientists and professional men make important contributions to the teaching in some Latin-American and Europeon institutions. The stimulus of the academic environment amply repays them for the time spent. The prestige of affiliation with an institution of higher learning far outweighs the salary, and the sense of accomplishment brings real satisfaction. Scientists in those areas actively seek the opportunity to teach; undoubtedly this reflects the high regard in which scholarship is held. The scholar is recognized whether he is a teacher or a researcher, and whether he is in industry or government, or is a full-time faculty man.

I maintain that in the United States the intellectual climate is favorable for obtaining a much wider participation in teaching by research men from industry and government. There are occasional books and papers put out about anti-intellectualism in America, (and it is true there are outbreaks disparaging intellectualism such as the "egg-head" episode during the 1956 election) but they are rare and short-lived, and the feeling against intellectual and cultural pursuits has waned in the last 25 years. Now we should be pressing for the wider recognition by business firms and government agencies that research scientists have much to gain as well as to contribute through teaching.

Administrative officers in academic institutions must devise simple procedures for accommodating properly qualified scientists as part-time members of the faculty; the teachers must see to it that the scientists added on a part-time basis are properly qualified both in subject matter and in teaching ability. Participation by industrial and governmental researchers in teaching cannot be wholly successful until their administrative officers are favorably disposed, give encouragement, and respect the scientists' responsibility to attend regularly and conscientiously to teaching commitments.

Governments can stimulate this trend, not only by making it possible for men to participate but also by its tax policies. If legislative bodies can entertain bills which would permit parents to deduct certain costs of higher education from their taxable incomes (and even from the net tax due) it should be possible to work out equitable and practical provisions so that a research man who devotes some time to teaching is not penalized for the small additional income. Further, if past experience is any guide, tax laws properly written and administered can be powerful stimulants for inducing research-scholars to share in the academic life of the teacher-scholars.

The title was chosen to highlight the viewpoint that research and teaching are inseparable—scholarship covers both. At this time, the emphasis should be on more and better teaching so that all of scholarship may be benefited.

JOURNAL OF GEOLOGICAL EDUCATION
Vol. 6, No. 1, Spring 1958, pp. 24-30

# MOTION PICTURES FOR GEOLOGIC TEACHING

HALL TAYLOR
*Columbia University*

ABSTRACT. Increasing numbers of motion picture films for geologic teaching are becoming available, but the sources from which they may be secured are widely scattered and in some instances little known. Brief descriptions are given of reference catalogs listing all known films of geologic interest available for loan in the United States. In addition, a number of 16-millimeter motion pictures suitable for use in geologic teaching are described, and information given on sources from which they may be borrowed, and costs. Some pointers on film care and projection are also presented.

Teachers hold widely varying opinions about the value of visual aids in geologic instruction. Some enthusiastically endorse them, and utilize them at every opportunity. Others accord more restrained support, but are happy to use them if they are readily available. And some, remembering perhaps the extra time required to prepare and utilize most visual aids—time which could profitably be spent on research or other activities—regard lectures and laboratory study, unaccompanied by any eye-catching diversions, as *the* method for college teaching. They may even deprecate the use of visual aids by others.

But for those who wish to supplement lecture and laboratory work, numerous aids are available. Among these, movie films are particularly useful, for they show aspects of geology which can scarcely be described adequately in classroom lectures. Many such films, mostly of 16-millimeter size, have been made. Some are in color; others, black and white. Many have sound tracks; a few, only silent printed titles. Some have been prepared by professional studios; others obviously by rank amateurs. Lengths vary greatly, some running for an hour or more, others only a few minutes. Many are available for loan at the low cost of return shipping charges; for others, a daily rental fee is collected.

Sources of these films are widely scattered and, even with some of the best, not well known. Various catalogs list many of them, however.

For geologists, the most complete reference has been the "Directory of Films and Slides of Possible Interest to Geologists," last published in 1951 by the American Association of Petroleum Geologists, Box 979, Tulsa 1, Oklahoma. Cost is 50 cents, and distribution is now being handled by the American Geological Institute, 2101 Constitution Ave., N.W., Washington 25, D. C. This publication is now partially out of date, and a revision is being planned by the A. G. I.

A cumulative catalog of 16-millimeter films entitled "Educational Film Guide," and covering the entire educational and entertainment field is published by the H. W. Wilson Co., 950 University Ave., New York 52, N. Y. With supplements published thru 1957, it lists about 17,000 films. Part 1 contains a title and subject index; part 2 classifies each film by subject matter according to the Dewey decimal system, describes it, lists Library of Congress card number, and gives purchase and rental sources and other pertinent data.

A somewhat less comprehensive but excellent directory is the "Blue Book of 16-millimeter Films," published by Educational Screen Inc., 2000 N. Lincoln Park West, Chicago 14, Illinois. It alphabetically indexes films by title, and also groups them under nearly 200 separate subjects (including Geology, No. 125), very briefly describes each film and lists distributor sources. The last cumulative edition, containing some 7,500 titles, appeared in 1953.

The "Blue Book of Audio-Visual Materials," also published by Educational Screen Inc., is an annual catalog supplementing and bringing up to date the "Blue Book of 16-millimeter Films." The last edition covered the year 1956.

An "Educator's Guide to Free Films," published by Educators Progress Service, Box 497, Randolph, Wisconsin, at $7.00, is a cumulative catalog, revised annually, of 16- and 35-millimeter films available for "free" loan (except for transportation costs) in the U. S. The 1957 edition lists 3,880 films, alphabetically indexed by title, and cross-indexed according to subject matter. Brief descriptions of each picture are given, and the loaning agency listed, together with terms under which films may be borrowed.

A 198 page, 1956 revised edition of "A Directory of 3,300 16mm Film Libraries" is available from the Superintendent of Documents, Washington, D. C., for 70c. The catalog number is FS 5.3:956/12. In it, libraries are arranged by states and cities, thus making information on local sources of films readily available.

Even the best of films should be regarded as a supplement, not a substitute, for class explanations and text study. Few students absorb visual information so rapidly that they will learn the entire contents of a moving picture at one or even several showings. This is no reflection on the film or the students, but rather a realistic appraisal of potentialities. Even so, one movie shot with sound effects of, let us say, a marsh buggy rolling across trackless swamps and carrying a seismic shooting crew, gives a more vivid and lasting impression of this subject than could hundreds of the best chosen words, or even a sequence of text pictures.

Educational films for non-commercial use may be mailed at special parcel post rates so low they probably contribute to the post office department's perennial deficit. If the addressee is within the first three zones or—Texans take note—within the state where mailed, the rate is 4c for the first pound or fraction thereof, and 1c for each additional pound or fraction. Beyond zone three (300 miles) the rate becomes 8c for the first pound and 4c for each additional pound. In accordance with Postal Laws and Regulations, films in the first category should be marked, beside the address, "34.83 P. L. and R.," and those in the second category, going to the fourth zone or beyond, "34.84 P. L. and R."

Films are expensive to produce, yet are comparatively fragile and easily damaged. Film passing thru a projector starts and stops 16 (silent speed) or 24 (sound speed) times each second, thru the action of a claw mechanism which engages the sprocket holes. Unless a machine is perfectly adjusted, it can quickly damage the film. Thus, a projectionist must understand thoroughly his work and his machine, and should stop the projector immediately at any sign of malfunctioning.

Sound films, with sprocket holes on one side only, cannot be shown in "silent-type" projectors which have paired sprockets designed to engage both sides of the film. The reverse is not true. Most sound projectors will show silent films, if they can be run at a speed of 16 frames per second. Some films are now appearing with sound recorded on a magnetic "soundstripe," rather than in a visual path, at the side of the film. Only projectors equipped to handle such magnetic recordings can produce sound from such films, altho any sound projector will show the picture portion. Stereo projection requires additional special equipment, but few such films are as yet available.

The following descriptions of films cover many geologic subjects and give some indication of the variety now available to geology teachers. Each film is listed alphabetically by title, and information given on size, whether sound or silent, color or black and white, projection time, year of release (if known), content résumé, audience suitability, and source from which it may be borrowed. Unless otherwise noted, the only loan cost is payment of return shipping charges and insurance.

"A" IS FOR ATOM. 16 mm. Sound. Color. 14 minutes. 1953.

Résumé. After first explaining simply, with the use of animation, such terms as proton, neutron, electron and isotope, and their places in atomic theory, this film considers the release of energy by nuclear fission, then examines the present and future uses of the atom in industry and research.

Audience suitability. Elementary in its approach, but an excellent film for students who have no background knowledge of simple atomic theory.

Distributor. General Electric Film Libraries, 570 Lexington Ave., New York 22, N. Y., and in more than a dozen major cities.

A THIRD DIMENSION FOR OIL. 16 mm. 3-D. Sound. Color. 20 minutes. 1954.

Résumé. The use of air photos and photogeologic techniques in the search for oil is explained in this, the first "three-dimensional" industrial film to be produced. Viewing may prove difficult for some, inasmuch as glasses must be worn, but the realistic illusion of depth in the pictures on the screen is interesting and well worth the extra bother.

Audience suitability. For all geology students, particularly those beginning the study of photogeology or geologic field methods.

Distributor. Geophoto Services, Ernest and Cranmer Bldg., Denver 2, Colorado. Because of the specialized projection equipment needed, this film is loaned only for special events, and can be shown only when a company representative or operator experienced in 3-D projection is available.

AIRBORNE MAGNETOMETER. 16 mm. Sound. B. and W. 23 and 34 minutes (short and long versions). 1952.

Résumé. The U. S. Geological Survey and the Civil Aeronautics Administration have cooperated to produce a relatively non-technical film showing aerial magnetic surveying, and the way it aids production of maps of underground ore deposits. After a brief review of elementary magnetic theory, the camera examines a dismantled magnetometer, then goes along on a flight by a U. S. G. S. plane, picturing the various steps by which data are gathered and a map produced. The longer version (34 minutes) is more complete and more technical.

Audience suitability. For college geology classes beginning the study of geophysical field methods.

Distributors. Civil Aeronautics Administration and U. S. Geol. Survey central offices in major cities.

AMERICAN FRONTIER. 16 mm. Sound. B and W. 28 minutes. 1953.

Résumé. This is a story of oil discovery a few years ago in the Williston basin of North Dakota. It begins by reviewing some of the hardships met and conquered by pioneer

settlers in that land of rolling hills and harsh climate. Then come the first geologists looking for surface structural clues, followed by geophysicists probing beneath the surface. Land men soon vie for promising acreage; the permanent residents wonder what will happen if oil should be found (and even plan just a little for such a contingency); bits start turning; and after long, uncertain waiting, oil froths into the sludge pit. Portrayed realistically are some of the hopes, disappointments, risks, and rewards which accompany any successful private enterprise venture by the American oil industry.

Audience suitability. For high school to adult audiences. Geological only in a few places, but it portrays realistically something of the life of a field petroleum geologist, and would be useful in any course emphasizing field geological training.

Distributors. American Petroleum Institute, 50 W. 50th Street, New York 20, N. Y., and also many film libraries.

BAHAMAS — WHERE LIMESTONES GROW TODAY. 16 mm. Sound. Color. 40 minutes.

Résumé. Nearly half the world's oil comes from limestone reservoirs; this film shows some of the ways in which such reservoirs form today. Filmed primarily in the Bahama Islands the picture presents first a brief tectonic review of the Caribbean region, and then examines in some detail the characteristics of "coral" reefs (which may contain comparatively little coral). Many underwater shots show the three major types of carbonate debris around the Bahamas: coral reefs, lime muds and oölitic limestones. Vegetation growth and sedimentation on reefs are considered, and pictures shown of many submarine sandbars and dunes. The film ends with an interpretation of the relations of Bahama geology to the search for oil in other limestone areas.

Audience suitability. A scenically colorful picture that would be interesting to anyone, but its discussion is primarily for serious students of ecology, paleontology, and petroleum geology. First year physical geology students would here see illustrated some of geology's many unsolved problems.

Distributors. Film Library, Humble Oil and Refining Co., Box 2180, Houston 1, Texas.

(THE) BIG SEARCH. 16 mm. Sound. Color. 10 minutes.

Résumé. A summary review of geological and geophysical methods used in the search for oil, with some particularly good marsh buggy and offshore drilling shots.

Audience suitability. A good introduction to the practical economic geology of oil; also for classes in geologic field methods.

Distributor. Film Library, Humble Oil and Refining Co., Box 2180, Houston 1, Texas.

BIRTH OF AN OIL FIELD. 16 mm. Sound. Color. 30 minutes.

Résumé. After first citing some of the uses of oil, this film considers how it is found. Cable and rotary drilling techniques and nomenclature are described, and such terms as mud flow, fishing, whipstocking, coring and gun perforating are explained with animation. Oil field terms such as drill collar, christmas tree, walking beam and sucker rods, are used and illustrated. Oil is struck half way through the film; the background chorus sings "Drill Men Drill," and one expects at any moment to hear the sound track burst forth with the triumphal march from "Aida." But the excitement passes, and the latter portion of the film calmly describes some phases of production engineering, such as gas and water pressure drives, repressuring, and oil pumping. In the 1957 revision of this film a petroleum engineer replaces the animated siphon bottle that injected a childish note into earlier editions.

Audience suitability. For classes in petroleum geology, field methods, or introductory economic geology.

Distributor. Film Library, Shell Oil Co., 160-07 Northern Blvd., Flushing 58, New York.

BLACK DIAMONDS. 16 mm. Sound. Color. 30 minutes.

Résumé. Narration by Lowell Thomas introduces this film on anthracite coal—its formation, mining, distribution, and use. Some portions are non-geologic, and there are a number of publicity plugs, but the film has much of geologic interest to those who are studying coal.

Audience suitability. A good introduction to coal for any geology class.

Distributor. Sterling Movies, Inc. (agent for Anthracite Information Bureau, 342 Madison Ave., New York 17, N.Y.), 43 West 61st St., New York 23, N.Y.

EVOLUTION OF THE OIL INDUSTRY. 16 mm. Sound. Color. 29 minutes.

Résumé. This kaleidoscope reviews the development of the oil industry from early Babylonian tar pits to modern petrochemical factories and offshore drilling rigs. Highlights include the following: Drake's discovery well of 1859; the first pipeline, laid in 1865; early refining practices which saved kerosene but discarded gasoline; the origin and migration of oil (only briefly considered); the modern search for oil reservoirs through use of varied tools and techniques from the fields of geology, geophysics and geochemistry; the recovery and refining of petroleum, and the enrichment of modern life through use of petroleum products.

Audience suitability. A good introduction to the economic geology of oil, both for first year students and those who are somewhat more advanced.

Distributor. Graphic Services, U.S. Bureau of Mines, 4800 Forbes Street., Pittsburgh 13, Pa.

FOSSIL STORY. 16 mm. Sound. Color. 19 minutes.

Résumé. An elementary introduction to fossils for those with no paleontologic background. Against backdrops of such famous geologic localities as the Grand Canyon, the Petrified Forest, and Rancho La Brea the film examines in a once-over-lightly fashion many diverse forms of life, including bacteria, algae, diatoms, foraminifera, trilobites, dinosaurs and amphibians.

Audience suitability. For classes beginning the study of fossils.

Distributor. Film library, Shell Oil Co., 160-07 Northern Blvd., Flushing 58, New York. Several other geologic films are available here, and also at Shell offices in Chicago, Houston and San Francisco.

GEOPHYSICAL OPERATIONS IN SAUDI ARABIA. 16 mm. Sound. Color. 12 minutes. 1955.

Résumé. Pictured in this short film are some of the logistical problems which arose in seismic exploratory work in the Arabian desert. There are some starkly realistic shots of the Rub al Khali, and of a well drilling for that most precious of all liquids in the desert —water.

Audience suitability. For any class studying field methods in geology and geophysics.

Distributor. Public Relations Department, Geophysical Service Inc., 5900 Lemmon Ave., Dallas 9, Texas.

(THE) HELICOPTER AS AN AID IN ALASKA SURVEYS. 16 mm. Silent. Color. 15 minutes.

Résumé. A poorly photographed picture of a helicopter trip made to establish a bench mark on an otherwise inaccessible Alaskan peak. However, it may help recruiting for the Alaska branch of the U.S.G.S.

Audience suitability. For classes in geologic field methods.

Distributor. Map Information Office, U. S. Geological Survey, Washington 25, D. C.

IN THE BEGINNING. 16 mm. Sound. Color. 28 minutes.

Résumé. A well-planned, beautifully photographed history of the Grand Canyon region from its early pre-Cambrian beginnings to the present day. Dramatically portrays the effective work of running water, surging waves, grinding ice, and abrading winds in shaping a portion of our earth's surface through geologic eons.

Audience suitability. For first year geology classes, especially those beginning the study of concepts in historical geology.

Distributors. Public Relations Department, Socony Mobile Oil Co., 150 E. 42nd Street, New York, N. Y.

ISLAND ODDITIES. 16 mm. Sound. Color. 26 minutes.

Résumé. A husband-wife team, Wesley and Constance Mueller, has here recorded on film some of the antics of birds, crabs, termites, octopi, sea urchins, starfish and other denizens of the coral shores of the Bahama islands.

Audience suitability. Good entertainment for any group. Geological only in its picturing of modern coral shore environments and ecology.

Distributor. Sales Dep't., Esso Standard Oil Co., Hutchinson River Parkway, Pelham, N. Y. (Loaned only in states where Esso products are sold.)

LET'S VISIT JAMAICA. 16 mm. Sound. B. and W. 24 minutes. 1954.

Résumé. After introductory shots of Montego Bay, Kingston airport, and resort hotel life in Jamaica, the camera focuses for a time on open pit bauxite mining which began on the island during World War II. It then continues by picturing the gathering of aluminum ore, its transportation by conveyor belts and buckets to central plants where it is crushed, dried and stored, and finally its shipment to refineries in the U. S. This film amply advertises the work of its producer, but in addition it gives a good idea of problems encountered by mining geologists and engineers in opening up ore reserves in a foreign country.

Audience suitability. Of value for classes in mining geology and geologic field methods.

Distributors. Advertising Dept., Reynolds Metals Co., 2500 S. Third St., Louisville 1, Ky.

LEVELLING FOR TOPOGRAPHIC MAPPING. 16 mm. Sound. Color. 20 minutes. 1950.

Résumé. The U. S. G. S. prepares its topographic maps by third order levelling methods, using for most base reference elevations 28 tide point stations along the Atlantic, Gulf and Pacific coasts, together with more than 300,000 bench marks established throughout the country. The methods used in this work are here described, and pointers given on instrument work, stadia rod techniques, and note taking.

Audience suitability. For those studying geologic field methods or civil engineering.

Distributors. Map Information Office, U. S. Geological Survey, Washington 25, D. C.

MINING FOR NICKEL. 16 mm. Sound. Color. 43 minutes. 1955.

Résumé. The opening scenes examine several of the mineralogical and geographical sources of nickel, after which the picture concentrates on operations in the Sudbury district. Explanatory and mining methods are described, and diagramatically illustrated, with explanations being given of common technical terms. Near its end the picture considers some of the uses of nickel in our expanding industrial economy.

Audience suitability. For students in economic, field and mining geology.

Distributor. Rothacker, Inc. (for the International Nickel Co.), 729 Seventh Ave., New York 19, N. Y.

NEPTUNE'S OIL FIELDS. 16 mm. Sound. Color. 27 minutes.

Résumé. As it becomes increasingly difficult to discover new oil reserves beneath the lands, earth scientists turn to that vast and still relatively untapped source, the continental shelves. This picture outlines the history of offshore drilling in the Gulf of Mexico from its crude beginnings in the late 1930's, with wooden derricks on pilings a mile or so from shore, to the beehive activity of the middle 1950's, with wells out of sight of land in 100 feet and more of water. Here is a story of how man has used all available resources such as war surplus equipment, shoran, seismic exploration, drilling "know-how" and geological skill in finding new oil reserves beneath the sea.

Audience suitability. For petroleum and economic geologists or other interested in the economic aspects of oil.

Distributor. Kerr McKee Oil Industries Inc., 306 N. Robinson, Oklahoma City 2, Okla.

OIL FOR TOMORROW. 16 mm. Sound. Color. 30 minutes.

Résumé. This is a panoramic story of America's oil, told through scenes showing its discovery, production, refinement, and transportation. An old yet interesting film despite its out-of-date statistics. Borrowers must pay *insured express* charges both ways, making transportation costs, which depend somewhat on distance, as much as five or even ten times those of films received by prepaid parcel post.

Audience suitability. For any group beginning study of geologic field methods, economic or engineering geology.

Distributor. Interstate Oil Compact Commission, Box 3127, Oklahoma City 5, Okla.

PETRIFIED RIVER. 16 mm. Sound. Color. 29 minutes.

Résumé. Here is a bit of the modern saga

of America's crash program search for adequate domestic reserves of uranium, beginning in World War II. The story opens with the formation of uranium ores in the shifting sands of the Colorado Plateau 200 million years ago. Subsequently this wonder element is concentrated in twisting channelways, "petrified rivers" buried in the rocks. Finally comes man's discovery of uranium on the Plateau, following by mining and milling of the ore within the last decade. Realistically depicted are some of the problems and difficulties associated with geologic work and mining operations in the beautiful but rugged plateau country. The picture closes with a discussion of atomic fission, the use of radioisotopes in medicine and industry, and some of the potential future benefits to mankind of this amazing source of energy.

Audience suitability. For general groups as well as classes in economic, field and mining geology.

Distributor. Graphic Services, U.S. Bureau of Mines, 4800 Forbes St., Pittsburgh 13, Pa.

PETROLEUM GEOLOGY. 16 mm. Sound. B. and W. 34 minutes.

Résumé. Roaring lustily, mechanical dinosaurs cavort clumsily through this film, snatching pterodactyl dinners from the air and biting deeply into each other's papier-mâché hearts. Interspersed with such falderal, however, is some basic petroleum geology. Thumbnail sketches outline paleogeographic and evolutionary changes through geologic time. Rocks form, and are deformed. Oil originates, migrates and accumulates, and (surprise!) geologists find it by studying such things as rocks, cores and structures. An old film, some of the scenes are off center, the sound track is not always clear, but withal the picture does present some basic geologic information.

Audience suitability. For elementary geology classes *after* their introduction to basic ideas in sedimentation and evolution.

Distributor. Union Oil Co. of California, 617 W. 7th Street, Los Angeles 17, California.

PHOTOGEOLOGY—A NEW LOOK FOR OIL. 16 mm. Sound. Color. 20 minutes. 1953.

Résumé. The preparation of maps and geologic reports from aerial photos requires extensive background knowledge of geology, and careful analysis of every scrap of available information. In this picture we see the many steps necessary first to gather information, then to classify and collate it, and finally to put it in a form which is readily usable by clients. A good introduction to the science of photogeologic interpretation.

Audience suitability. For elementary classes in photogeology and geologic field methods.

Distributor. Geophoto Services, Ernest and Cranmer Bldg., Denver 2, Colorado.

PORTRAIT OF THE EARTH. 16 mm. Sound. Color. 23 minutes.

Résumé. Some basic principles of aerial photography are reviewed with the aid of props. including a lovely sweater girl. Then attention is focussed on airborne geophysical surveying, including use of a Varian nuclear magnetometer and a scintillation counter, in the search for uranium deposits on the Colorado Plateau. Finally the electro-magnetometer and its role in the hunt for supplies of copper and lead are considered.

Audience suitability. For introductory classes in field methods, geophysics, photogeology, and introductory physical geology.

Distributor. Hycon Aerial Surveys, Inc., 1020 S. Arroyo Parkway, Pasadena 2, California.

PROSPECTING FOR PETROLEUM. 16 mm. Sound. Color. 23 minutes.

Résumé. Here is a simple elementary story of why men need oil and how they search for it, probing the earth with such tools as magnetometers, gravimeters and seismographs. Information thus gathered is added to geologic knowledge assembled from fields such as micropaleontology, geomorphology and structural geology to provide a picture of areas where oil reserves (estimated at 80 billion barrels for the entire world!) are most likely to be found.

Audience suitability. For the general public or those just beginning geologic study.

Distributor. Film Library, Shell Oil Co., 160-07 Northern Blvd., Flushing 58, N. Y.

(Concluded in the Fall Issue)

# BOOK REVIEWS

*Glacial and Pleistocene Geology.* Richard Foster Flint. xiii and 553 pp., 134 figs., 51 tbls., 5 pls. John Wiley & Sons, Inc.; New York, 1957. $12.50.

Pleistocene research has accelerated at such a rate since *Glacial Geology and the Pleistocene Epoch* appeared ten years ago, that only those truly interested could expect to keep themselves properly informed on their own specialty. Geologists the world over now are indebted for this current up-to-date summary of glacial and Pleistocene geology. The greatest advances have been in fields closely related to geology, namely, geochemistry, marine stratigraphy, pedology, cryopedology, palynology, and glaciology. The results of recent research in all these fields are here amplified for the professional. This book then is in part a compilation of a decade of Pleistocene research.

Much of the compactly written basic or standard glacial geology of the earlier volume also is retained. Some chapters are completely reorganized and rewritten, others revised and brought up to date. The book is designed so that the first 17 chapters are glacial geology and could be used for a course in that subject; the last 10 chapters deal with Pleistocene geography and stratigraphy of North America, of Europe, of areas outside of North America and Europe, with deep-sea floor stratigraphy, with Pleistocene fossils, and with the causes of glaciation, and could be used in a course on Pleistocene geology. The new chapters, although containing some material familiar to readers of the first book, are Frozen-Ground Phenomena (12 pp.), Weathering and Soils; Stream Regimens (15 pp.), Fluctuation of Lakes in Nonglaciated Regions (18 pp.), Crustal Warping (18 pp.), and Stratigraphy of Deep-Sea Floors (7 pp.). Most correlations are offered tentatively only in table form. Of the 49 photographs, only 15 are aerial views. The maps either are more legibly redrawn or are new. The list of 866 references is admittedly an attempt only to support the text, but the researcher will find plenty to read in his favorite subject. The whole book is printed on thick glossy paper, a fact undoubtedly accounting in part for the regretably high cost, a cost which especially is unfair to the student, and which unfortunately puts the book in the category of one that "only the library can afford."

The excellent chapters on elements of glaciology emphasize the need for personal firsthand knowledge of glaciers before significant analyses of their effect may be made. As much of the information derived from glaciological studies of the Greenland ice sheet as is now available is integrated into a smooth account of the regimen of that ice sheet, and pertinent data are listed for comparison with the former ice sheets of North America and Europe. In the chapter on Frozen-Ground Phenomena, the awkward but more easily understood words, such as frost wedging, solifluction, solifluction deposits, and permafrost unfortunately are still favored over the etymologically correct, more universally useful, and now accepted (especially by Europeans) terms introduced by Bryan in 1946. The request to abandon the no longer adequate concept of a "Tertiary period" and a "Quaternary period" again is suggested as most desirable, and the petition to use the terms recent and postglacial only informally and locally is solicited anew. The latter position is still stubbornly opposed by some members of the U. S. Geological Survey.

One cautionary change that may shock the reader searching for a correlation of a certain popular moraine, or loess, or soil with one of the standard Wisconsin subdivisions is that any such correlation purposefully has been avoided. The substages of the Wisconsin, formerly strongly supported, are mentioned but once and then only to indicate that they can be employed but locally. The appropriateness of correlating other drift sheets with these substages is questioned. Instead, the innocuous phrase "classical Wisconsin drift" with all its implications is used throughout. This is a far cry from Morris Leighton's recently proposed six substages. The closest to a correlation offered is the listing of central North America equivalents of "Post-Sangamon" events (Table 23-B) in a chapter on the Stratigraphy of Europe. This conservative approach otherwise is the theme.

SIDNEY E. WHITE
*The Ohio State University*

*Chemistry in Introductory Geology.* W. D. Keller, iv and 84 pp. Lucas Brothers: Columbia, Missouri.

Dr. Keller has undertaken the highly commendable but Herculean task of attempting a simplified explanation of the chemical nature of earth materials and processes, primarily for students with no chemical background. The book should prove to be a valuable adjunct to the many new and revised texts covering physical geology. Some readers may be disappointed in the lack of detail accorded some topics, such as deposition of ore minerals, but in general the topics are covered concisely yet with adequate detail.

Unfortunately, several typographical errors mar the book. Among these are: the dolomite formula on page 39, the omission of the K electron shell from the atomic structure diagram of chlorine on page 9, and on page 29 the amphibole formulae are described as having an "$Si_4O_{11}$ ratio (twice that of $Si_8O_{11}$)."

The reviewer feels that several figures do not serve the needs of beginning students. Figure 6 might be improved by a new photograph and possibly a modified sketch. Figures 7, 9, 13, 14 and 16 would be enhanced by "index" or orientation drawings relating the crystal structure to the more familiar macroscopic crystals.

One might speculate on the wisdom of suggesting "generalized" mineral formulae after reading the good discussion of crystal structure as a function of lattice thermal energy during the cooling of a magma. In the same vein, it might have been better to show the alkali feldspars as a discrete reaction series rather than the penultimate progeny of the continuous and discontinuous series. Of the references cited, few are directed at the elementary level.

The book is very timely, but will probably best serve as a coordinated review of geologic processes for more advanced geology students *with* a background in chemistry.

C. T. BRESSLER
*Western Washington College*

*The Admirable Discourses of Bernard Palissy.* Translated by Aurèle La Rocque. vi + 264 pp. University of Illinois Press: Urbana, Ill. 1957. $5.50.

Bernard Palissy the potter was in spirit a man of the Renaissance, though this his book was not published until 1580. Primarily an artisan with a sense of beauty, he was also a real scientist, not just an interested person who made lucky guesses about nature. His book is concerned chiefly with (1) the origin of springs and the hydrologic cycle, (2) metals and alchemy, (3) salts, (4) rocks, (5) clay, (6) the potter's art, and (7) marl.

Palissy was a good observer. He saw that springs emerge just above layers of dense rock, that reservoirs must have impervious floors, that "marcasites" are square and crystal (quartz) diamond-pointed, that the places where marl has been piled temporarily in a field produce the richest harvest. He gloried in his reliance on his own observations: "I have had no other book than the sky and the earth" (p. 148).

Palissy's principal qualification for recognition as a scientist is no doubt his understanding of hydrostatic pressure and hydrostatic equilibrium as applied to the behavior of water in and on the earth. The salt makers beside the Ocean sea (Bay of Biscay) know that water only flows downhill. The sea cannot feed springs directly; it is too low. Springs of sweet water come from the rain and the rain comes from clouds that gain their vapor from sea and land (p. 53). The water in wells may rise higher than where the auger (of a modern type invented by Palissy) has found it, because it has "come from higher up than the bottom of the hole you have dug" (p. 218).

Palissy's considerable knowledge of salts and metals did not get him very far, chemically speaking. He asserted that the alchemists were tricksters who could not really make gold. He maintained that there are many kinds of salts: common salt, saltpeter, alum, vitriol, copperas, etc. Rocks are said to contain salts. Salts dissolved in water are considered a fifth element, a "congelative" water that is an addition to the four elements: earth, air, fire, and "exhalative" or ordinary water. Congelative water produces metals, bones, crystals, and eyeglasses, and petrifies shells (pp. 104-106).

The most moving section of the book is "On the Art of the Earth" (pp. 188-203), the story of Palissy's almost endless frustrations in his attempts to make fine pottery. "I went to bed at midnight or at dawn . . . Retiring . . . dirty and wet, I would find in my bedroom a

second persecution worse than the first" (pp. 200-201).

The Introduction, the 216 footnotes, the Annotated Bibliography of 68 items, the almost complete absence of typographical errors, and the clarity of the text all bear witness to the skill and care of the translator. For each old book in the Bibliography there is a list of the American libraries where it can be found. The whole book is very attractive and the only aid that is missing is an index.

George White and the Illinois Press gave us Playfair in 1956 and Palissy in 1957. What will they do next?

A. O. WOODFORD
*Pomona College*

# TRANSACTIONS
# OF THE
# ASSOCIATION OF GEOLOGY TEACHERS

MINUTES OF THE BUSINESS SESSION, SEVENTH ANNUAL MEETING, NOVEMBER 6, 1957. The meeting was held in the Vernon Room of the Haddon Hall Hotel, Atlantic City, New Jersey. President Berg called the meeting to order at 1:40 P.M. The reading of the minutes of the last annual meeting was dispensed with since they were printed in the *Journal of Geological Education*.

President Berg read the presidential report for 1957. No financial report was submitted as Treasurer Allen was unable to attend the meeting. The financial statement appears in these *Transactions*. Secretary Prouty reported on the affairs of his office for the year.

Copies of the two constitutional changes, as appended below, were circulated for consideration. President Berg reported that the Executive Committee had voted to allocate $2.50 of each member's payment to the National Treasury leaving $.50 for Section dues. A. O. Woodford, reporting for the Far Western Section indicated that section considered $.50 dues insufficient to operate satisfactorily.

Nominations from the floor were made to supply the Neil Miner Committee with two members-at-large. A. O. Woodford and John B. Lucke were elected. Richard Mahard was appointed as hold-over member on the Committee.

President Berg presented the Neil Miner Award for 1957 to George A. Thiel. Dr. Swan received the award for Dr. Thiel who was unable to attend the meeting. Inscribed on the certificate was the following: "The Neil Miner Award to George Alfred Thiel for exceptional contributions to the stimulation of interest in the Earth Sciences."

Donald Boardman reported on the two weeks conference proposed to be held at the Wheaton College campsite in the Black Hills. The National Research Council has been approached in a preliminary way concerning support for the conference. The present plan for the conference is for the summer of 1959.

President Berg discussed briefly the subject of the AGT relationship to the Geological Society of America. It is hoped that at least a half day will be assigned to a business meeting at Saint Louis in November 1958 to discuss this and other important business matters.

President Berg read the results of the election of officers for 1958, as follows:

President; C. E. Prouty, Michigan State University

Vice President; Milton Heald, West Virginia University

Secretary; Freeman Foote, Williams College

Treasurer: James C. Brice, Washington University (Saint Louis)

There being no further business the session was concluded at 2:30 P.M.

Respectfully submitted,

C. E. PROUTY, *Secretary*

PRESIDENTIAL ADDRESS. Dr. J. R. Berg presented his presidential address on "The Definition of Geology." He examined some of the difficulties encountered in building acceptable curricula because of the fragmentation of the science which is still proceeding apace, and noted that a sound geological curriculum requires clarification of the scope and objectives, which, in turn, must rest on a clear definition of geology. Dr. Berg examined some historical definitions of geology. He pointed out that several of these imply that geology involves the application of other sciences to a study of the earth. After discussing the position of geologists as compared with other scientists Dr. Berg suggested that it becomes all important to see to it that future geologists are well grounded in such basic subjects as chemistry, physics, mathematics and biology. On this firm foundation we can hope to synthesize and fuse the findings of these several sciences into new and useful geologic concepts, and avoid the evils of over-

specialization and the resulting fragmentation of geology.

Developments in recent months have called for critical appraisal of the scientific achievements behind the "Iron Curtain." In this connection Dr. Berg called attention to the high status in both Soviet Russia and China of the Ministries of Geology, whereas in this country the Geological Survey is only one of several divisions which must compete for Department of the Interior funds. In spite of the long continued effort on the part of the profession, geology is not included in the curriculum at either West Point or Annapolis. In fact, geology is taught on a four year degree basis at only about eleven percent of America's 1854 colleges and universities, and is practically unknown at the high school level. Dr. Berg humorously noted that a master of ceremonies once introduced him to an audience as a *theologist* rather than a *geologist.*

Dr. Berg concluded his remarks with an urgent request that the members of the AGT give financial, physical, mental and moral support to their professional organization which is pledged by its constitution to "foster improvement in the teaching of the earth sciences at all levels of formal and informal instruction, to emphasize the cultural significance of the earth sciences, and to disseminate knowledge in this field to the general public."

REPORT OF THE SECRETARY. During the past year a membership drive has raised the membership to 530, as compared with 423 a year ago, an increase of about twenty per cent. Included in both figures, however, are a number who are delinquent in their dues. Although the increase is gratifying it is still small compared to what it should be. Revised membership lists were sent to the Executive Committee in May, 1957. Plans are being considered to distribute membership lists to all members.

Due to considerable concern as to the financial status of the National organization, the Secretary, at the request of the President, submitted to the Executive Committee in February, 1957 a list of several possible ways to raise funds. The Committee considered that the best means was to revise the apportionment of the annual dues with $2.50 going to the National Treasury and $0.50 going to the section. Section Treasurers generally considered this to be an equable distribution. The Executive Committee voted 11 to one in favor of this change.

Other actions taken by the Executive Committee since last year's annual meeting in Minneapolis but prior to 1957 should be reported to this meeting. Approved by the Committee was the recommendation "that members who pay dues for a particular dues year be entitled to receive the two issues of the *Journal of Geological Education* published during the following calendar year." This was recommended because the *Journal* is issued on a calendar year basis but the dues year begins September first. A second recommendation to repeal the following ruling was approved by the Committee: "A discount to agencies handling the *Journal* of 20% on each subscription or back-issue order from a foreign institution or individual outside of the continental United States or its territories." Implicit in this nullification would be that all discounts to agencies, both foreign and domestic, will now be the customary 10%. A third recommendation approved by the Committee read as follows: "That no issues of the *Journal of Geological Education* be sent to members whose dues are in arrears, and that mailing of current issues of the *Journal* to such members be resumed only on payment of current dues ....." This excludes, as previously, Honorary Members and those retired teachers who, because of financial hardship, pay no dues to the Association. A resolution passed by the Committee reads as follows: "That the Association discontinue the practice of copywriting issues of the *Journal of Geological Education.*"

The Pacific Northwest Section was formally organized at the time of the Northwest Scientific Association meeting at the University of Washington, Seattle, December 28, 1956. The section proposed that Alaska, British Columbia and western Montana be added to the present geographic coverage of Washington, Oregon and Idaho.

Little progress has been shown towards the development of a South Plains section. John J. W. Rogers states that there is considerable interest in that area and that perhaps next year a section may be organized. The potential

Southwest Section appears to be in about the same stage of development.

The Nominating Committee in selecting a slate of officers for the coming year found it neeessary to place only one name on the ballot for each office, with the exception of the Secretary. This points again to the advisability of following in the future the suggestion made by a number of members that only one candidate for each office be nominated, with write-in privilege for additional choices.

Respectfully submitted,

C. E. PROUTY, *Secretary*

*Suggested changes in the constitution of the Association of Geology Teachers.*

Article I—NAME

The name of the organization shall be the *National* Association of Geology Teachers.

Article VI—COMMITTEES

*Section 2.* POLICY COMMITTEE. A permanent steering committee selected from the membership at large and composed of teachers of 20 years or more of teaching experience. The Committee to select its own chairman. Each year the retiring National Chairman and National Secretary to serve for a one year term. Vacancies by death or illness to be filled by appointment by the active Executive Committee of the AGT. This committee will have as its primary function the statement of the underlying philosophy of the AGT, its scope and service to the profession. It will act as a "hearing committee" on matters of violation of professional ethics.

*Section 3.* CURRICULUM AND STANDARDS COMMITTEE. Selected by the Executive Committee now in office. To be a permanent committee, with representation from each section, selected preferably from those members who are acting, or have acted, as departmental chairmen. Vacancies filled as in Section 1, Article VI.

*Section 4.* FINANCE COMMITTEE. To be selected from the membership at large, by the present Executive Committee of AGT. The chairman to be designated at the time of appointment. This committee will examine the financial policy of AGT and examine carefully the possibility of establishing a permanent office for the AGT with a permanent Executive Secretary.

*Section 5.* MEMBERSHIP COMMITTEE. An annually appointed committee serving a one year term. To be selected by the Executive Committee as early in the term of the Executive Committee as possible. The membership of this committee should be composed chiefly of younger members of AGT. Its functions will be to propose restrictions (if necessary) on membership; to suggest ways and means of encouraging all teachers to become affiliated with AGT, and to state policies regarding eligibility.

THE ASSOCIATION OF GEOLOGY TEACHERS was founded in the Middle West in May, 1938. In November, 1951, it was organized as a national association, under which there are at present seven organized regional sections: Central, East Central, Eastern, New England, Far Western, Southeastern, and Pacific Northwest. An annual meeting of the national association is normally held in the fall, and sectional meetings are held in the spring.

The purpose of the Association, as stated in its Constitution, is "to foster improvement in the teaching of the earth sciences at all levels of formal and informal instruction, to emphasize the cultural significance of the earth sciences, and to disseminate knowledge in this field to the general public."

Anyone concerned with geological education, formal or informal and at any age level, is invited to apply for membership. *Inquiries should be addressed to the national secretary,* FREEMAN FOOTE, Williams College Williamstown, Massachusetts.

## NATIONAL OFFICERS, 1958

President: CHILTON E. PROUTY, *Michigan State University*
Vice President: MILTON T. HEALD, *West Virginia University*
Secretary: FREEMAN FOOTE, *Williams College*
Treasurer: JAMES C. BRICE, *Washington University* (St. Louis)
Editor: MILDRED F. MARPLE, *The Ohio State University*
Editorial Committee: The National editor and treasurer and the section editors

### CENTRAL

Pres.: DONALD C. BOARDMAN
*Wheaton College*
Vice Pres.: OLIVER R. GRAWE
*Missouri School of Mines*
Secr.-Treas.: DOROTHY J. GORR
*The Principia College*

### EASTERN

Pres.: ERLING DORF
*Princeton University*
Vice Pres.: J. DONALD RYAN
*Lehigh University*
Secr.-Treas.: MAURICE B. ROSALSKY
*The City College of New York*
Editor: LAWRENCE WHITCOMB
*Lehigh University*

### FAR WESTERN

Pres.: ROBERT M. NORRIS
*University of California, Santa Barbara*
Vice Pres.: NORMAN DOLLOFF
*San Jose State College*
Secr.-Treas.: FREDERICK C. GROS
*University of Redlands*
Editor: A. O. WOODFORD
*Pomona College*

### EAST CENTRAL

Pres.: WAYNE D. MARTIN
*Miami University*
Vice Pres.: H. GRAY MULTER
*The College of Wooster*
Secr.-Treas.: LOIS J. CAMPBELL
*University of Kentucky*
Editor: SIDNEY E. WHITE
*The Ohio State University*

### NEW ENGLAND

Pres.: ARTHUR A. SOCOLOW
*University of Massachusetts*
Vice Pres.: ALONZO QUINN
*Brown University*
Secr.-Treas.: MARSHALL SCHALK
*Smith College*

### SOUTHEASTERN

Pres.: E. W. BERRY
*Duke University*
Vice Pres.: WILLIAM R. HIGGS
*Louisiana Polytechnic Institute*
Secr.-Treas.: CASPAR RAPPENECKER
*University of Florida*

### PACIFIC NORTHWEST

Pres.: CHARLES D. CAMPBELL
*Washington State College*
Vice Pres.: NORMAN R. ANDERSON
*University of Utah*
Secr.-Treas.: EDWARD P. THATCHER
*University of Oregon*